

Gammage Bird Sampling

Objective: We aim to characterize the bird community that uses the area around Gammage Auditorium in the summertime, and to understand the Gammage site within the broader urban ecology of the Phoenix metropolitan area. This characterization will be compared to future bird survey data to assess the impacts of land management decisions on the ecology around Gammage Auditorium.

Background information:

Gammage Auditorium is located on the west side of the Arizona State University Tempe campus. It is part of the Phoenix metropolitan area, which has a population of more than 4.8 million people (US Census Bureau 2021). It is located in south central Arizona, and in the northern extent of the Sonoran Desert. The Phoenix metropolitan area has been inhabited for over 2000 years, and the Hohokam people developed the canal infrastructure upon which the city was developed after European colonization. After World War II, the city experienced rapid population growth, and ongoing development and population growth continue to affect the structure of ecological communities across the city (Warren et al. 2019).

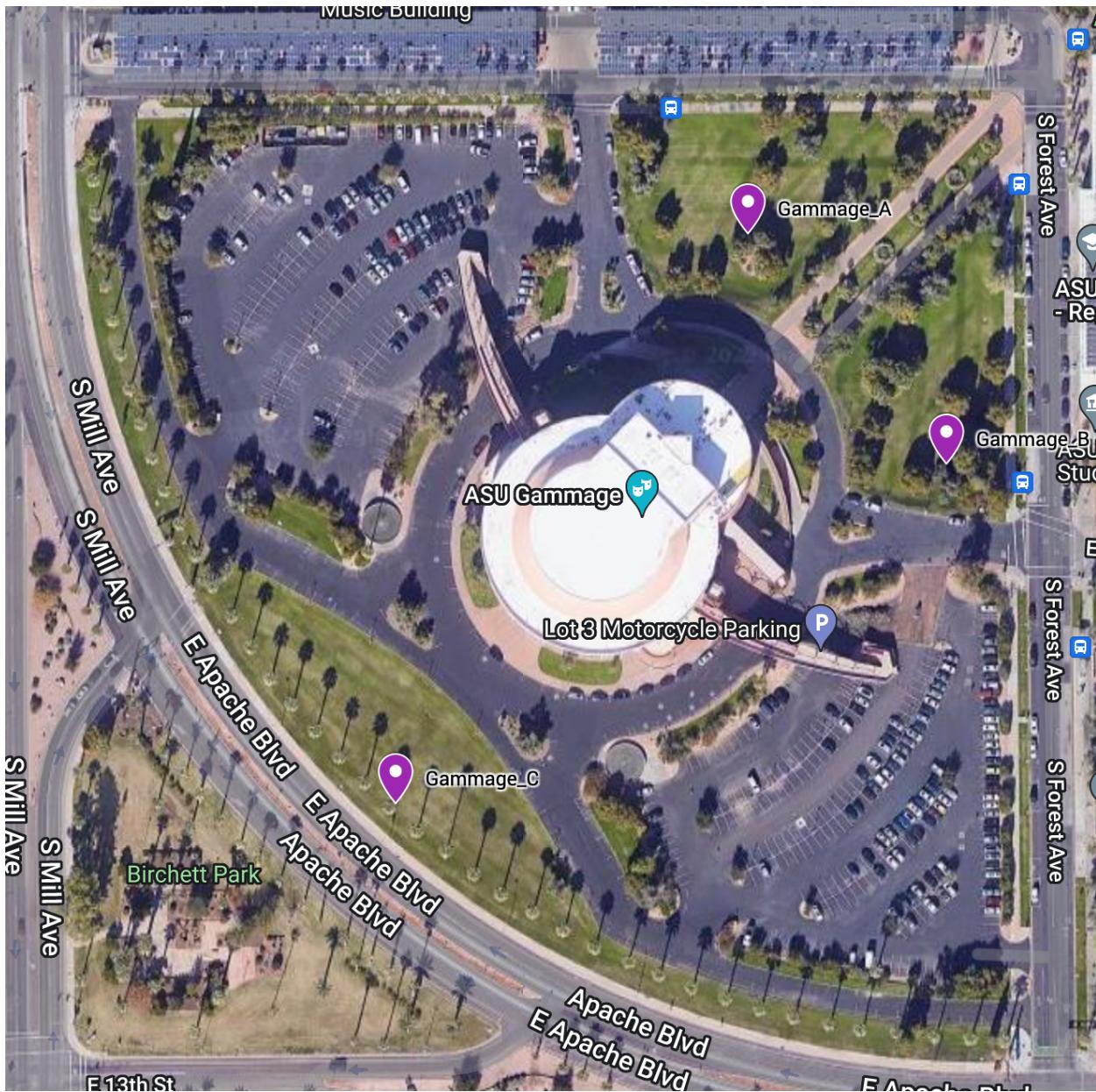
The landscaped areas around Gammage Auditorium consist mostly of turf lawns, palm trees, and non-desert trees and shrubs. Plans to “rewild” this area will reshape the landscaping to better reflect a native Sonoran Desert ecological community. We anticipate that the changes to the vegetative landscape will alter the avian community, and we aim to quantify those changes.

Sampling protocol:

- Describe sampling approach (timing, intent, logistics)
- Describe LTER protocol and how it was modified for the sampling
- Map of sample sites

We followed the CAP LTER Core Birding Point Count Protocol (https://github.com/CAPLTER/caplter-research-protocols/blob/master/CoreBirding/CoreBirding_PointCount_Protocol.md), but with a modified approach for selecting our locations. Point count surveys of all birds at a site were completed at three sites in the landscaped areas around Gammage Auditorium: Gammage A, Gammage B, and Gammage C. All three sites were surveyed on three different days in the month of August. On the first and last day, only one observer was present (Danny Jackson) but on the second day a secondary observer was present (Shane Henderson). Birds noted by the secondary observer were recorded under “Notable additional bird species” section and were not included in this analysis. Each survey was conducted for 15 minutes and all birds within a 40-meter radius of the observer were recorded. We selected these three sites to capture the diversity of landscaping types around the Gammage Auditorium.

Figure 1. Map of the sites surveyed around Gammage Auditorium.



Species observed:

We observed 12 avian species across our 3 sites, with a mean of 8.33 species per site. Mourning doves and rock pigeons were the most abundant, with a total of 180 mourning doves and 174 rock pigeons. American Kestrels and northern mockingbirds were equally rare, with only two observed individuals each. 4 nonnative species were present: European collared doves, European starlings, rosy-faced lovebirds, and rock pigeons. The remaining 7 species are native to the area, although 5 are contemporarily broadly distributed throughout the contiguous United States: American kestrel, great-tailed grackle, house finch, mourning dove, northern

mockingbird. Anna's hummingbirds, Gila woodpeckers, and white-winged doves have more restricted ranges: respectively, the Pacific coast and Sonoran Desert, the Sonoran Desert, and the American southwest (southern Texas to Arizona).

Table 1. Species list

Species	Code	Gammage A	Gammage B	Gammage C	Total
American Kestrel	AMKE	0	0	2	2
Anna's Hummingbird	ANHU	4	8	0	12
European Collared Dove	EUCD	8	0	12	20
European Starling	EUST	10	10	10	30
Gila Woodpecker	GIWO	2	6	4	12
Great-tailed Grackle	GTGR	2	4	14	20
House Finch	HOFI	8	8	0	16
Mourning Dove	MODO	168	8	4	180
Northern Mockingbird	NOMO	0	2	0	2
Rosy-faced Lovebird	RFLO	6	0	30	36
Rock Pigeon	ROPI	70	0	104	174
White-winged dove	WWDO	4	0	0	4

Data analysis

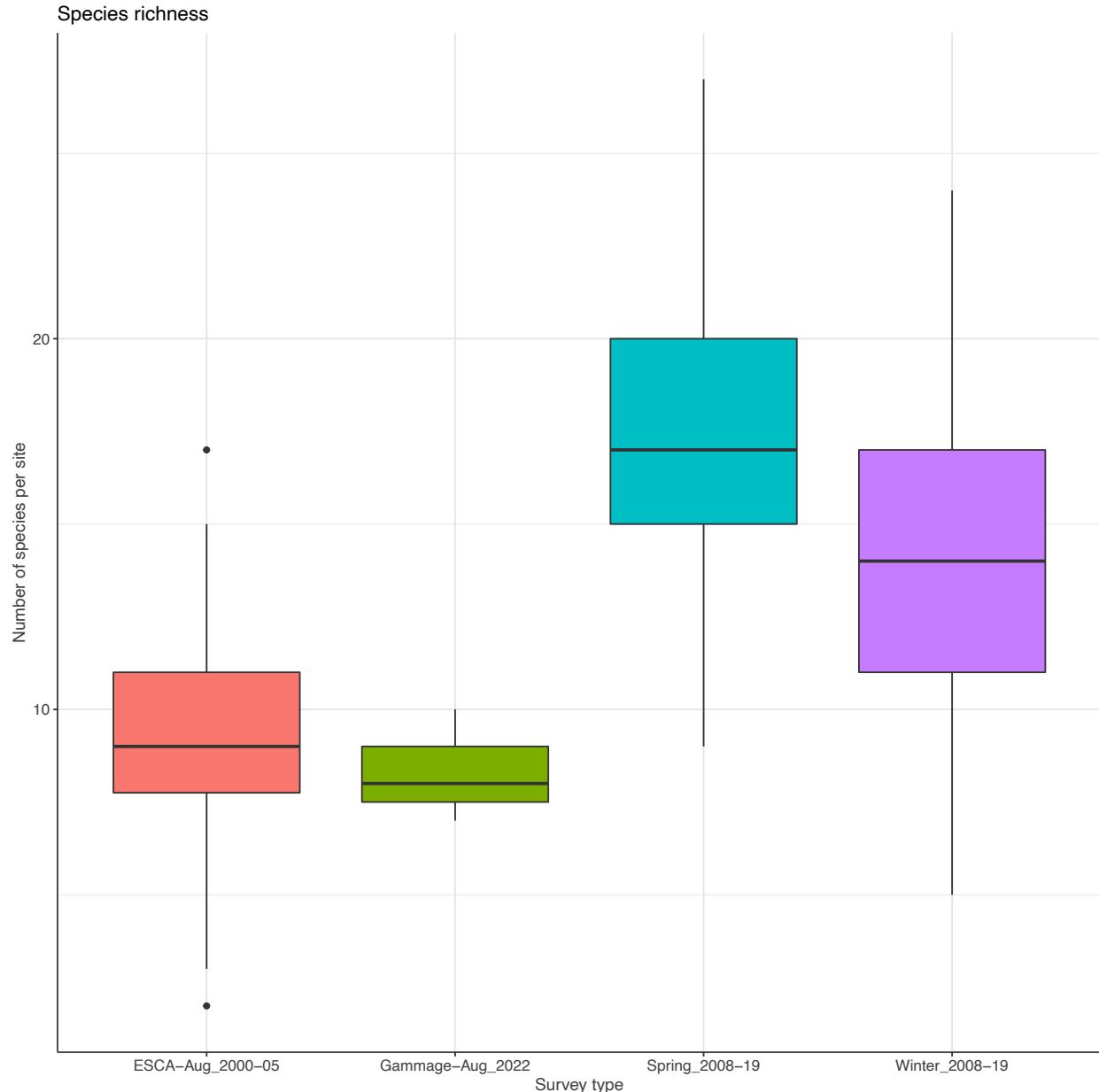
Survey data was prepared in python and analyzed in R, using the package "vegan." Scripts used to prepare and analyze the data can be found at

https://github.com/dannyjackson/SpatialEcology_CampusBirds. To contextualize the Gammage ecology within existing analyses of the broader Phoenix area, we analyzed the survey data from Gammage along with several subsets of data from the CAP LTER long term bird survey dataset (LINKS). We included all sites from the 2008 and 2012 Phoenix Area Social Surveys. Given that species abundance has declined over time in the Phoenix area (Warren et al. 2019), we also included the most recent available CAP LTER surveys, which were from 2019. Following Warren et al. 2019, we split these data into Winter and Spring surveys (Winter: December of the previous year-January; Spring: March-May). Finally, we included all surveys from the month of August in the available Phoenix Area bird survey dataset, which were all done by the Ecological Survey of Central Arizona (ESCA) from 2000-2005.

We found that the Gammage sites had the lowest mean species richness of the four categories, followed by the ESCA surveys conducted in August of 2000-2005 (Figure 2). This suggests that summer avian communities exhibit less species richness in the Phoenix area than winter or spring communities. It also suggests that the site at Gammage exhibits a low species richness in comparison to the overall Phoenix ecology. However, given that avian species richness has declined across Phoenix over time (Warren et al. 2019) and that we were unable to compare our surveyed sites to any surveys conducted in August that were more recent than 2005, the

low species richness at Gammage could be a result of an overall decline in species richness across the Phoenix area, rather than a low species richness at the Gammage site.

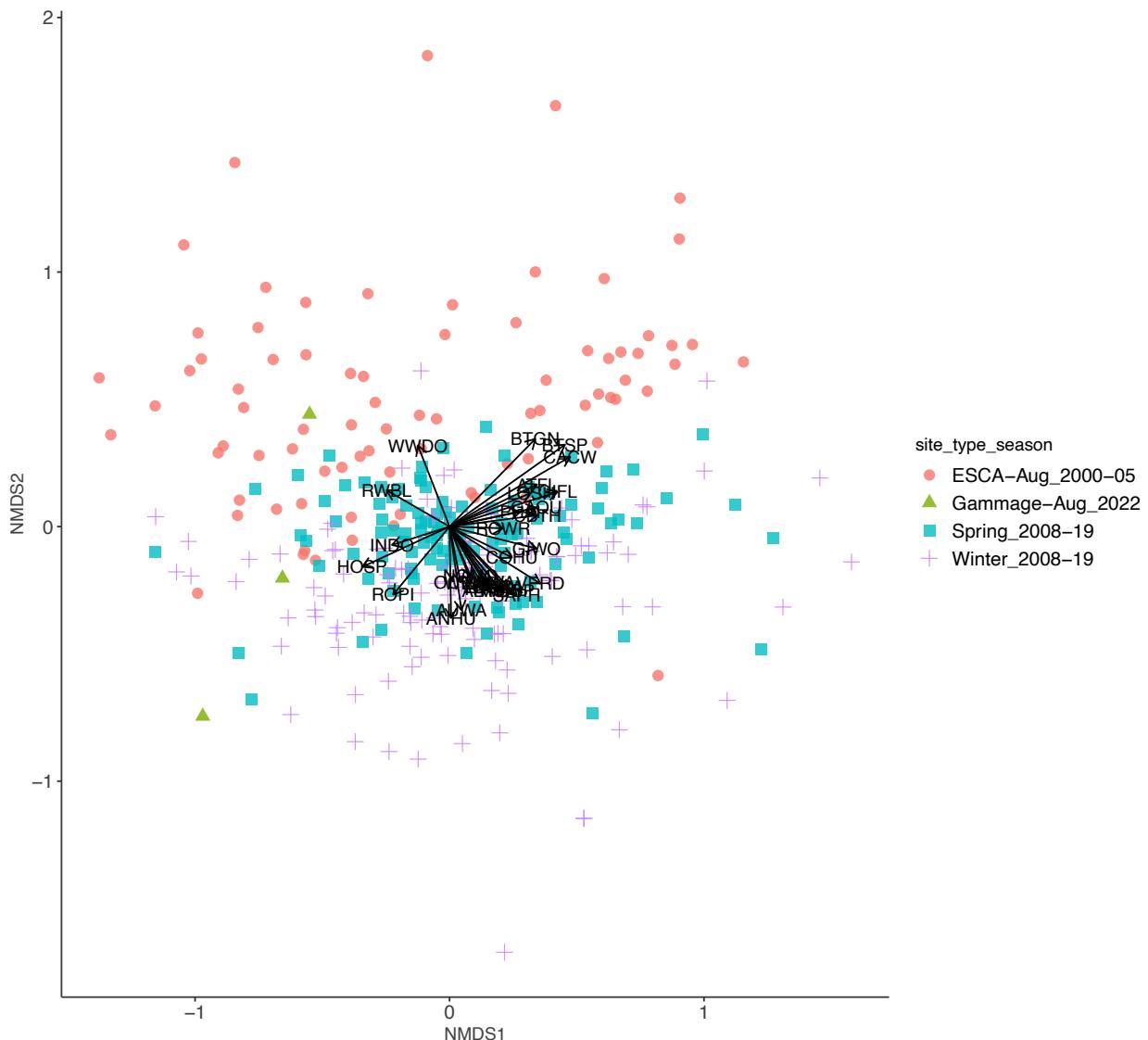
Figure 2: Species richness by survey season



We also performed a non-metric multidimensional scaling model of our sites, which is an indirect gradient analysis approach that depicts the relationships between surveyed sites based on a dissimilarity matrix. We also plotted the linear relative contribution of each bird species to the dissimilarities of our sites. Figure 3 shows the three Gammage sites clustering together in the same half of the plot, but they do not appear to cluster more closely with any other group.

The presence and abundance of rock pigeons and Anna's hummingbirds likely drove the distribution of two Gammage sites into the lower half of the plot, and the presence and abundance of white-winged doves likely drove the other Gammage site into the upper half of the plot.

Figure 3: NMDS plot of site dissimilarities based on species abundance



Citations

U.S. Census Bureau. 2017. Population Estimates Program (PEP).
<https://www.census.gov/programs-surveys/popest.html>

Warren, P. S., Lerman, S. B., Andrade, R., Larson, K. L., & Bateman, H. L. (2019). The more things change: species losses detected in Phoenix despite stability in bird–socioeconomic relationships. *Ecosphere*, 10(3), e02624.